Geographic Distribution of the Genus *Parargyractis* Lange (Lepidoptera: Pyralidae) Throughout the Lake Erie and Lake Ontario Watersheds (U.S.A.)[1]

MICHAEL A. LAVERY AND ROBERT R. COSTA
DEPARTMENT OF BIOLOGICAL SCIENCES, STATE UNIVERSITY OF NEW YORK,
COLLEGE AT BROCKPORT, BROCKPORT, NEW YORK 14420

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Abstract: The geographic distribution of the immature stages of aquatic lepidopterans (genus *Parargyractis*) was studied in 43 streams throughout the American section of the Lake Erie and Lake Ontario watersheds. *Parargyractis* populations were commonly distributed throughout the watersheds, but the distribution was somewhat localized. In 64% of the streams where *Parargyractis* were found, larvae and/or pupae were relatively abundant. The immature stages were frequently encountered within the same community of insects that usually require clean stream conditions for survival (Plecoptera, Ephemeroptera, Trichoptera).

INTRODUCTION

Most insects of the large order Lepidoptera are terrestrial throughout their entire life history. However, some members of a few families of moths are capable of a true aquatic existence. Members of the pyralid genus *Parargyractis* are especially well adapted to an aquatic life in their immature forms.

Parargyractis larvae live in rapid streams on the surfaces of submerged rocks. Each larva is protected from the current by a case consisting of an irregular sheet of silk cemented around most of its periphery to the rock. The larvae move about under these silken cases feeding on diatoms and other debris of rock surfaces. Pupation occurs in oval, dome-shaped cocoons into which holes have been cut at each end to allow for passage of water. The pupa is suspended from the ceiling of the felt-like outer covering of the cocoon within a finely woven, silken, waterproof lining. Just before pupation the last instar larva cuts a crescent-shaped slit in the cocoon through which the adult will emerge. When gravid, the adult female enters the water, using its hind legs as oars, and glues groups of eggs onto rocks (Lange, 1956, 1971).

Little information exists relative to the geographic distribution of the genus *Parargyractis*. Lloyd (1914), the first investigator to describe the immature stages of *Elophila fulicalis* (now in *Parargyractis*), found larvae and pupae in only a limited area of Fall Creek, Ithaca, New York. However, in a similar stream nearby, it was absent. This led him to conclude that the distribution of

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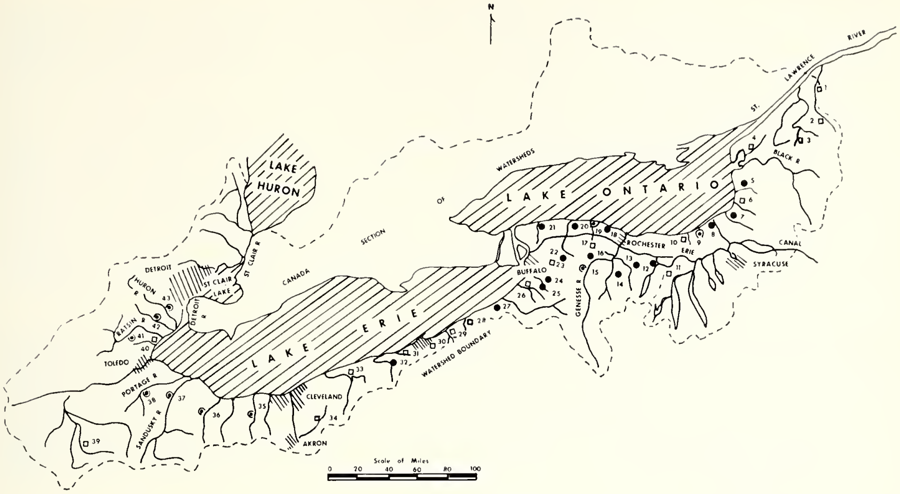

Fig. 1. Geographic distribution of *Parargyractis* throughout the American section of the Lake Erie and Lake Ontario watersheds. (● = present; ⊙ = present and very abundant; ☐ = not found. Number beside symbol refers to stream name and exact location of sampling area found in Table 1.)

P. fulicalis was extremely local. Forbes (1923), in his studies of the Lepidoptera of New York and neighboring states, found that *P. fulicalis* distribution was common and general. Pennak (1953) noted that although the geographic distribution of *P. fulicalis* was not completely known, it probably was common in the eastern United States. Welch (1959) noted that *Cataclysta* (now *Parargyractis*) was widely, but often only locally, distributed over the eastern half of the United States and northeastern Canada. Lange (1971) described four species of *Parargyractis* from California, and found members to be well represented in western United States.

Despite this common distribution, few stream studies have reported the presence of the immature stages of *Parargyractis*. Lavery and Costa (1972) have recently shown that a reason for this may be the selective nature of sampling methods commonly used in stream studies. They demonstrated that the Surber square-foot sampler, which is extensively used in North American stream surveys to sample benthic macroinvertebrates, was totally unreliable in estimating *Parargyractis* populations. They concluded that the behavior of *Parargyractis* larvae in constructing silken canopy-like cases that adhere tightly to rocks and their habit of lodging in crevices or depressions over which the case is built account for much of the unreliability. This apparent inaccuracy of the Surber sampler was also noted by Culley (1967) who took two samples in a stream densely populated with *Parargyractis* larvae and pupae (34 per square foot) but found only one larva in the Surber net. It is quite apparent that the selective nature of sampling methods used in stream studies accounts partially for the paucity of information on the biology and distribution of the immature forms of *Parargyractis*.

Hence, the genus *Parargyractis*, although thought to be widely distributed and common in the eastern United States, is often only encountered locally. However, almost no information exists on how extensive its distribution is within a definite geographic area. If members of this genus are common, there appears to be virtually no information available on the abundance of the immature stages in streams.

The objectives of this study, therefore, were: 1) to determine the extent of distribution of *Parargyractis* throughout a definite area, the American section of the Lake Erie and Lake Ontario watersheds, and 2) to estimate the numerical importance of *Parargyractis* larvae and pupae in streams within this defined area. It was hoped that in so doing the importance of this group in the ecology of benthic stream communities would be clarified.

METHODS

Streams within the Lake Erie and Lake Ontario watersheds having accessible riffle areas were chosen for sampling. Since it was temporally not feasible to sample all streams, an attempt was made to evenly allocate sampling areas throughout the two watersheds. When possible, the major streams (usually between 10 and 20 meters in width) were sampled.

Rocks were removed from riffle areas and carefully examined for the cases of *Parargyractis* larvae and pupae. The cases, when found, were ruptured with forceps and the immature forms were removed and preserved in 70% ethanol.

Duration of actual sampling was recorded in an attempt to quantify the sampling effort. A minimum of 30 minutes was spent sampling streams where few or no lepidopterans were observed. If many were encountered, sampling was often limited to less than 30 minutes. The total number found at each area was then determined and expressed as numbers found per thirty minutes of sampling. A numerical comparison between areas could then be made and the relative numerical importance assessed.

At each area, other invertebrates observed in the same habitat with *Parargyractis* were recorded. Usually these invertebrates were classified to family and then returned to the stream. In some instances, animals were classified only to order. These observations yielded general information on invertebrate populations commonly associated with *Parargyractis* populations.

RESULTS AND DISCUSSION

A total of 43 streams were sampled throughout the Lake Erie and Lake Ontario watersheds (Table 1). Members of *Parargyractis* were found in 58%

Table 1. Name and exact location of area sampled

Number[1]	Name	Location
	Lake Ontario Watershed	
1	Grasse River	St. Lawrence Co., N.Y. at bridge on SUNY A.T.C. Campus; Canton, N.Y.
2	Elm Creek	St. Lawrence Co., N.Y. on Rt. 87, just north of Hermon, N.Y.
3	Matoon Creek	St. Lawrence Co., N.Y. at bridge on Rt. 58 south of Guveneur, N.Y.
4	Perch River	Jefferson Co., N.Y. bridge on Rt. 180 south of Limerick, N.Y.
5	South Sandy Creek	Jefferson Co., N.Y. upstream from bridge on Rt. 11
6	Salmon River	Jefferson Co., N.Y. In town of Pulaski, N.Y.
7	Little Salmon River	Oswego Co., N.Y. at bridge on Rt. 69 just east of Colosse, N.Y.
8	Rice Creek	Oswego Co., N.Y. at bridge on Rt. 104
9	Sterling Creek	Cayuga Co., N.Y. downstream from bridge on Rt. 104A on west edge of town of Sterling, N.Y.
10	Wolcott Creek	Wayne Co., N.Y. downstream from Wolcott Falls in Wolcott, N.Y.
11	Flint Creek	Ontario Co., N.Y. south of Rt. 96 on west edge of town of Phelps, N.Y.
12	Canandaigua Outlet	Ontario Co., N.Y. downstream from bridge on Rt. 96
13	Mud Creek	Ontario Co., N.Y. upstream from bridge on Rt. 20
14	Honeoye Creek	Ontario Co., N.Y. upstream from bridge on Rt. 20
15	Oatka Creek	Genesee Co., N.Y. downstream from bridge on Rt. 63, 0.5 miles north of Pavilion, N.Y.
16	Black Creek	Genesee Co., N.Y. bridge on Rt. 237, 0.3 miles north of Byron, N.Y.
17	Spring Creek	Genesee Co., N.Y. bridge on Rt. 237
18	Salmon Creek	Monroe Co., N.Y. bridge on Rt. 31
19	Sandy Creek	Monroe Co., N.Y. north Hamlin, N.Y.
20	Marsh Creek	Orleans Co., N.Y. bridge on Sawyer Rd., 0.5 miles north of Rt. 18
21	Eighteenmile Creek	Niagara Co., N.Y. bridge on Rt. 104, 0.9 miles west of Wright's Corners, N.Y.
	Lake Erie Watershed	
22	Little Tonawanda Creek	Genesee Co., N.Y. downstream from bridge on Rt. 20
23	Cayuga Creek	Erie Co., N.Y. bridge on Rt. 358
24	Little Buffalo Creek	Erie Co., N.Y. bridge on Rt. 358 in village of Marilla, N.Y.
25	Buffalo Creek	Erie Co., N.Y. downstream from bridge on Rt. 20A in Wales Center, N.Y.
26	Eighteenmile Creek	Erie Co., N.Y. downstream from bridge on Rt. 5, west of Lakeview, N.Y.

TABLE 1. (*Continued*)

Number[1]	Name	Location
		Lake Erie Watershed Continued
27	Walnut Creek	Chautauqua Co., N.Y. upstream from bridge on Rt. 20, 0.25 miles west of Silver Creek, N.Y.
28	Chatauqua Creek	Chautauqua Co., N.Y. bridge at Hawley St. in Westfall, N.Y.
29	Twentymile Creek	Erie Co., Pa. bridge on Rt. 5
30	Mill Creek	Erie Co., Pa. Bridge on Rt. 97 in southern part of Erie, Pa.
31	Elk Creek	Erie Co., Pa. south of Rt. 20, west of Girard, Pa.
32	Conneaut Creek	Erie Co., Pa. downstream from bridge on Rt. 6n, 1 mile north of Cherry Hill, Pa.
33	Grand River	Ashtabula Co., Ohio, under bridge on Rt. 6
34	Cuyahuga River	Portage Co., Ohio, 0.25 miles west of Rt. 700, near town of Welshfield, Ohio
35	Black River (East Branch)	Lorain Co., Ohio, 0.2 miles east of Rt. 301
36	Vermilion River	Huron Co., Ohio upstream from bridge on Rt. 250 in Fitchville, Ohio
37	Sandusky River	Seneca Co., Ohio, 0.6 miles east of Rt. 53, bridge on Darr Rd., 4 miles north of Fort Seneca
38	Portage River	Wood Co., Ohio, bridge on Water St., Pemberville, Ohio
39	Ottawa River	Putnam Co., Ohio, upstream from bridge on Rt. 224 in Kalida, Ohio
40	South Otter Creek	Monroe Co., Mich. bridge on Rt. 25 in Casalle, Mich.
41	Raisin River	Monroe Co., Mich., bridge 2 miles north of Rt. 50; 4 miles south of Maybee, Mich.
42	Stony Creek	Monroe Co., Mich. east of bridge on Rt. 25 about 3 miles north of Monroe, Mich.
43	Huron River	Wayne Co., Mich. bridge on Rt. 24 in Flat Rock, Mich.

[1] Number corresponds to that found on Fig. 1.

of the 43 streams sampled. Immature stages were found to be widely distributed and common throughout the watersheds (Fig. 1). Distribution, however, was somewhat localized, for, in some cases, members were found in one stream but not in a very similar nearby stream. The conclusions of Pennak (1953) and Welch (1959) that members of *Parargyractis* are common and widely distributed throughout the eastern United States are supported by these findings. In addition, this study shows the extent of distribution in a given geographic area.

The quantitative estimates at each area where *Parargyractis* was found appear in Table 2. To facilitate evaluation, these estimates were classified into three categories: 1) very abundant; 26 to 87 specimens collected per 30 minutes;

Table 2. Abundance of *Parargyractis* immature stages at each area sampled; 18 May–17 September 1972

Number[1]	Date Sampled	Abundance, (no. per 30 min.)	Classification[2]
1	27 August	none	
2	26 August	none	
3	26 August	none	
4	26 August	none	
5	25 August	8	scarce
6	25 August	none	
7	25 August	16	abundant
8	1 August 1972	5	scarce
9	1 August	38	very abundant
10	1 August	none	
11	24 August	none	
12	4 August	1	scarce
13	26 August	16	abundant
14	26 August	2	scarce
15	26 July	28	very abundant
16	25 July	15	abundant
17	25 July	none	
18	20 May	16	abundant
19	18 May	70	very abundant
20	24 May	1	scarce
21	22 July	3	scarce
22	28 July	1	scarce
23	28 July	none	
24	28 July	1	scarce
25	28 July	20	abundant
26	10 August	none	
27	10 August	8	scarce
28	10 August	none	
29	17 September	none	
30	17 September	none	
31	17 September	none	
32	17 September	22	abundant
33	18 August	none	
34	18 August	none	
35	17 August	75	very abundant
36	17 August	48	very abundant
37	17 August	87	very abundant
38	17 August	26	very abundant
39	16 August	none	
40	16 August	none	
41	16 August	48	very abundant
42	16 August	45	very abundant
43	16 August	34	very abundant

[1] Number refers to exact sampling location found in Table 1.
[2] Classification; see text for explanation.

Table 3. Taxonomic list of other invertebrates found in same community with larvae and pupae of *Parargyractis*

Taxon		% of total streams	% of streams containing *Parargyractis*
Tricladida	Planariidae	57	48
Annelida	Hirudinea	7	9
Isopoda	Asellidae	10	9
Amphipoda	Gammaridae	22	17
Trichoptera	Hydropsychidae	100	100
	Hydroptilidae	35	35
	Helicopsychidae	20	30
Ephemeroptera	Baetidae	98	87
	Heptageniidae	75	70
Diptera	Chironomidae	98	98
	Simuliidae	52	48
	Tipulidae	22	26
Plecoptera	Perlidae	38	22
Coleoptera	Psephenidae	68	74
	Elmidae	32	35
	Dryopidae	7	9
Megaloptera	Corydalidae	2	4
Gastropoda	Ancylidae	20	26
	Various snails	29	20
Pelecypoda	Spaeriidae	22	30
Hydracarina		2	0

densely populated areas where larvae and/or pupae could be picked at will; 2) abundant; 15 to 25 specimens collected per 30 minutes; immature forms not densely populated yet easily found; and 3) scarce; 1 to 14 specimens collected per 30 minutes.

In streams containing *Parargyractis*, 40% had very abundant populations, 24% had abundant populations, while 36% contained scarce populations. Thus in 64% of the streams, immature stages of *Parargyractis* were abundant to very abundant. This appears to indicate that in many cases *Parargyractis* populations constitute important components of the stream biota. It further supports the belief that their quantitative importance as a group has apparently been underestimated (Lavery and Costa, 1972).

Other invertebrates commonly observed in the same benthic community with *Parargyractis* larvae and pupae are listed in Table 3. The five groups encountered in over 70% of the streams were: Hydropsychidae (Trichoptera); Baetidae and Heptageniidae (Ephemeroptera); Chironomidae (Diptera) and Psephenidae (Coleoptera). The Simuliidae (Diptera) and Planariidae (Tricladida) were found in about 50% of the streams. Hydroptilidae and Helicopsychidae (Trichoptera); Tipulidae (Diptera); Perlidae (Plecoptera); Elmidae (Coleoptera); Ancylidae (Gastropoda), various snails (Gastropoda); Spaeriidae (Pelecypoda); and Gammaridae (Amphipoda) were present in 20–30% of the streams. Of all these invertebrate groups (Table 3), many are usually associated with well-aereated, nonpolluted streams. Therefore, one can expect the immature stages of *Parargyractis* to be most often associated with clean stream environments, a finding which could be of considerable interest to stream-water-quality investigators.

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